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"Mobile clothing"
From wireless terminals to wireless end-user access embedded in clothing and accessories: radical implications on the supply chains

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NB

- *This presentation is NOT about Wearable computing , « Organic user interfaces » (CACM June 2008) or Intelligent textiles .*
- *It is about how to free your hands and attention, so that you and your body alone can be extended with wireless communications and media access*
- *To simplify terminology, « Mobile clothing » is the short-cut designation for wireless multi-network access embedded in clothing, with possible extensions beyond communications (e.g. medical monitoring etc)*

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Textiles and clothing sector

- The textiles and clothing sector is a diverse and heterogeneous industry which covers a wide variety of products from hi-tech synthetic yarns to wool fabrics, cotton bed linen to industrial filters or specialized industrial uniforms, or nappies to high fashion. This diversity of end products corresponds to a multitude of industrial processes, enterprises or market structures.

- Textiles and clothing account for around 4% of total manufacturing value added and 7% of manufacturing employment in the EU-15

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EU-15 Textile and clothing industry (2002)

Sources: Euratex, Eurostat

- Turnover : 186 BEuros
- Investment : 5,9 BEuros (3,2 %)
- Employment : 2,012 M
- Companies : 108 435 (average 19 empl./co)
- Average turnover/employee : 92615 Euros
- Imports extra EU : 70,2 %
- Exports extra EU : 40,7 %
- Net trade balance : -29 BEuros

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All-in-1 Mobile clothing product concept

- You buy in one distribution location a piece of clothing with enabled embedded wireless multi-network access
- Sub-systems for communications, storage and sensing are modular, removable, replaceable and customizeable
- Personalization/adjustments applies both to the clothing and to the mobile clothing sub-systems and can be ordered and tested locally
- Branding is linked to distribution network

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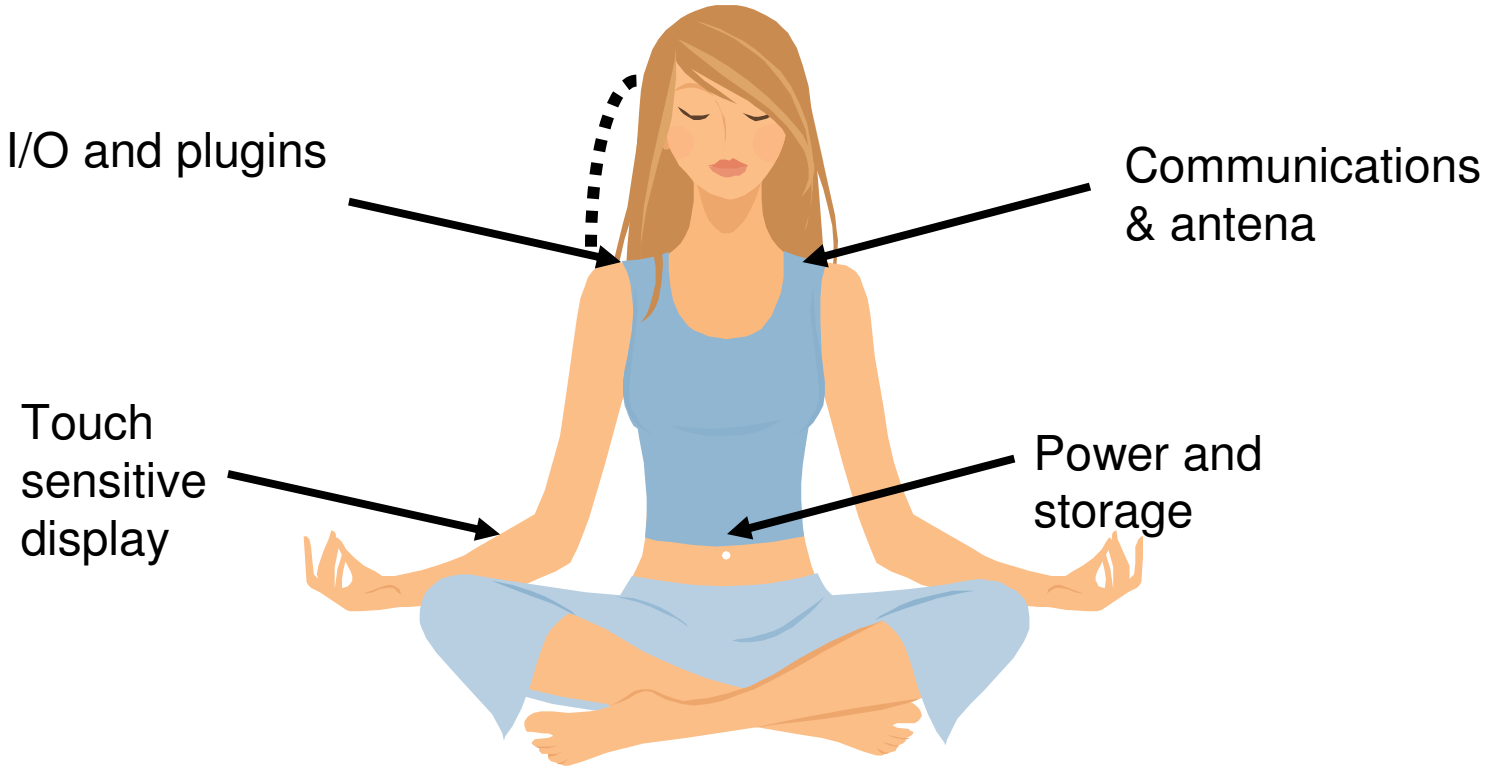
All-in-1 Mobile clothing



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All-in-1 Mobile clothing: some worries

- Health implications : whereas electromagnetic effects on the brain from wireless terminals is still not scientifically proven, mobile clothing removes transceivers further away from the brain
- Washing: electronic and battery packages are removable,

  while wireless enabled textiles must satisfy washability

Wireless access terminal paradygm shifts

Mobile clothing is one way forward

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1998-2008	2009-2019
Wireless handheld phone with growing functionality	Wireless multi-service platform (communications, Internet, video, music, games…)
Homogeneous world products	Market or user segment differentiation, not least on cost
Competition with fixed phone and broadband access nodes	Competition from a wide area of platforms with personal networking
Accessability, Media and Style	Fashion, Function and Fun; the symbolic and message bearing aspects of clothing
Addition to fixed phone with social and ubiquity advantages	Main interaction platforms with social, dependability, health monitoring and personalization advantages

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Key technologies and patents

Microelectronics	Textile Materials, power
Embedded passive components into substrates	Body heat thermogenerating textile fibers generating electrical power
Flexible LCD displays	Nanocrystals allowing for solar energy conversion while vaporized on fiber or as a film; non maging concentrators
OLED high contrast displays with photoemitting molecules and low consumption	Folded ultrathin camera lens
Flexible LED arrays for wearable announcements	Touch sensitive textile fibers
Wearable looks changing accessories (necklace..)	Woven textile reinforced thermoplastics
Vacuum roll-to-roll process for flexible OLED displays	eWall EMI/EMC protective textile against EM fields
Organic semiconductors	Self cleaning nano screens
Small scale GPS antennas and circuits	Thermo regulating microcapsules in fiber
RFID for configuration	Sticking markers and glues onto textile
Ultra-thin substrates	Textiles with shape memory
Photonic sensing skin	Lighting textile fibers
MEMS sensors with sub-threshold CMOS	Flagrance diffusion from microencapsulated textiles
Flexible 16/32 bit asynchronous processors via thin film transistors	Fuel microcell with H2O cartridges
New know how on on-body antennas and propagation	

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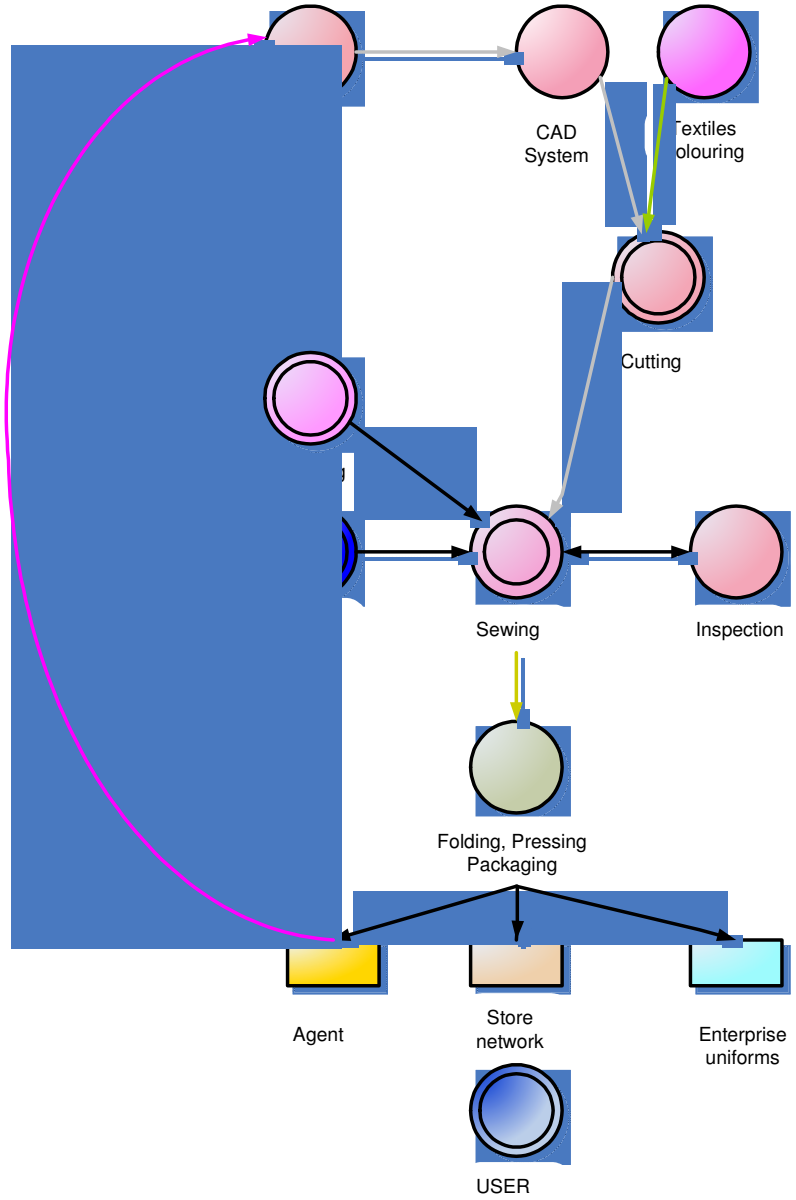
Clothing supply chain



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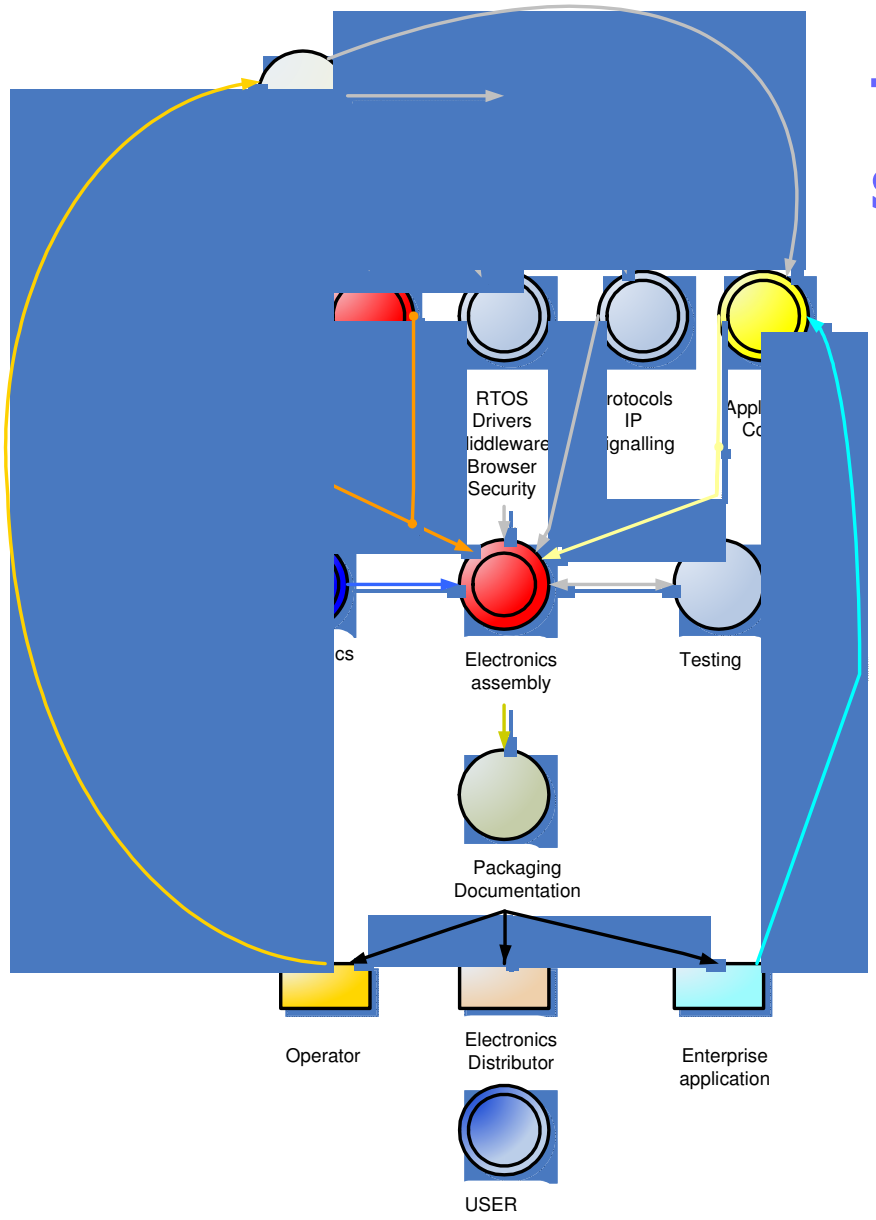
Mobile terminals supply chain



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Supply chain drivers

Wireless terminals

- Volumes 2 B units/y
- Linked to specialized communications and Internet industries,and their channels
- Centralized customization, service creation and content
- Channels with low storage rotation speed
- Channels with low value-added to terminals suppliers , and mostly as operator promoters
- Large parts of electronics assembly outsourced
- Slowing wireless terminals renewal rate
- High value brands

Mobile clothing

- Volumes in clothing 15 B units/y
- « All-in-1 » concept with clothing with communications access
- Linked to clothing and other decentralized industries with large value-added mass customization experience
- Channels with high storage rotation speed
- Channels with flexibility in clothing redesign and accessories as well as personalization
- Strength of design and fashion differentiators
- High value brands or no-brand approaches
- Most of manufacturing is by native industries in same areas as electronics outsourcing
- Increasing clothing renewal rates

+ Equalization of margins inside supply chains

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Mobile terminals assembly

- Besides dwindling supplier-owned fabs, Specialist electronics contract manufacturers (Solectron, Sanmina, HTC, etc) , which sometimes become terminals suppliers by « learning »
- Large product series volumes only
- Testing and inspection far from customer front-ends
- Reverse logistics on complete handsets

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Mobile clothing assembly

- Diversified low tech clothing assembly
- Medium to small product series volumes
- Testing, inspection and customization at client premises or close to client premises
- Reverse logistics of specialized electronics modules
- Local repairs or improvements for textile parts

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Mobile terminals distribution and retail

- Vertical supply chains (supplier owned, operator owned, national chains)
- Problems with vertical value chain relationships driving up margins
- Lack of customer focus

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Mobile clothing distribution and retail

- Subsystem to horizontal diversified value-adding networks distribution model
- Existence of specialist or strongly branded distribution channels
- Rather small distribution and retail margins decoupled from margins on sub-systems
- Potential for clothing and retail industries in MVNO space
- Power of trendy low-cost fast-renewed and customized clothes (Inditex/Zara, H&M etc :they produce less than ¼ in Asia)
- Risks with high tech subsystems and needed retail facilities

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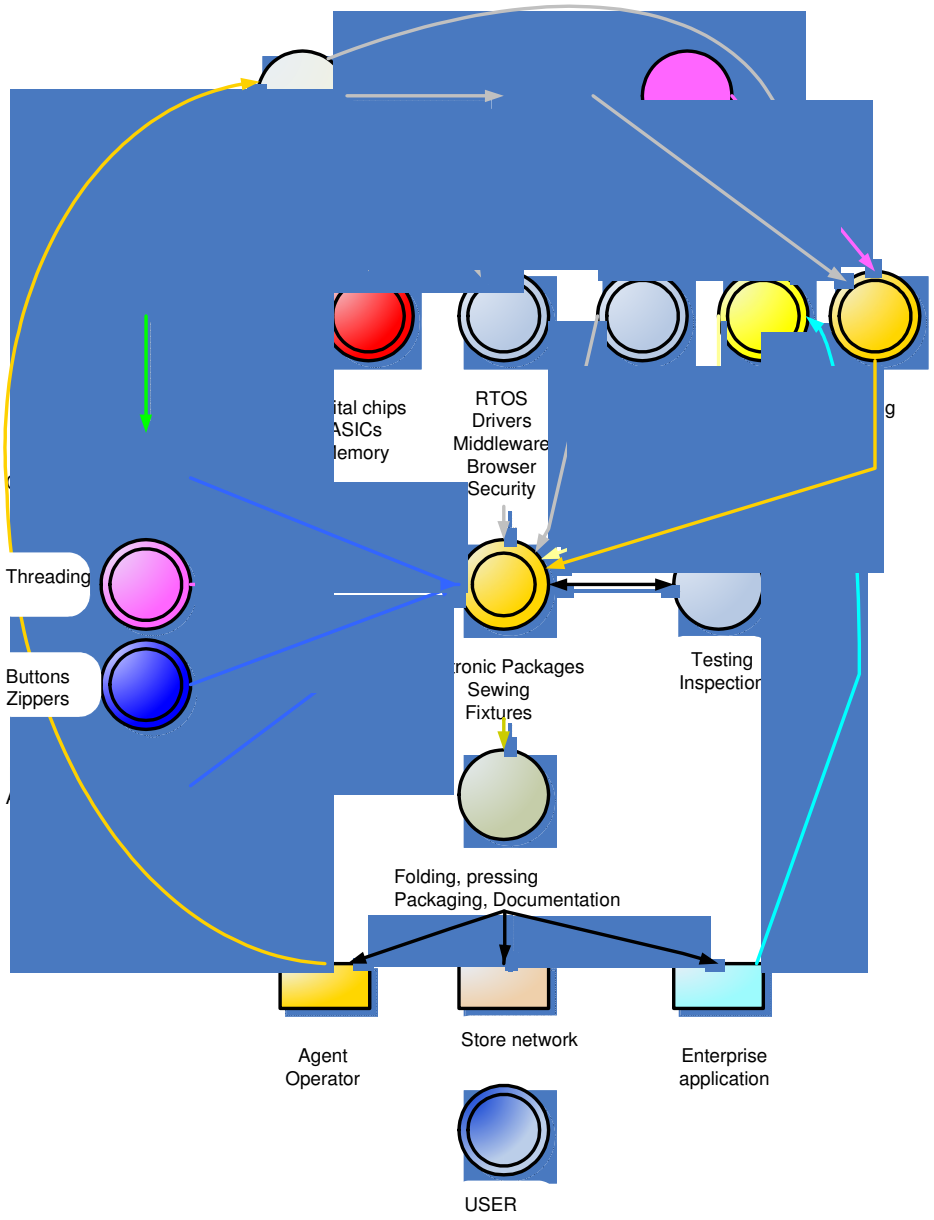
Mobile clothing supply network



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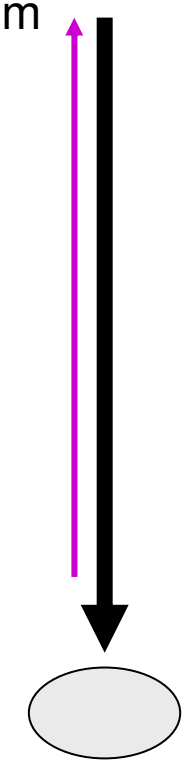
Supply chain differences I : customization

Mobile terminals

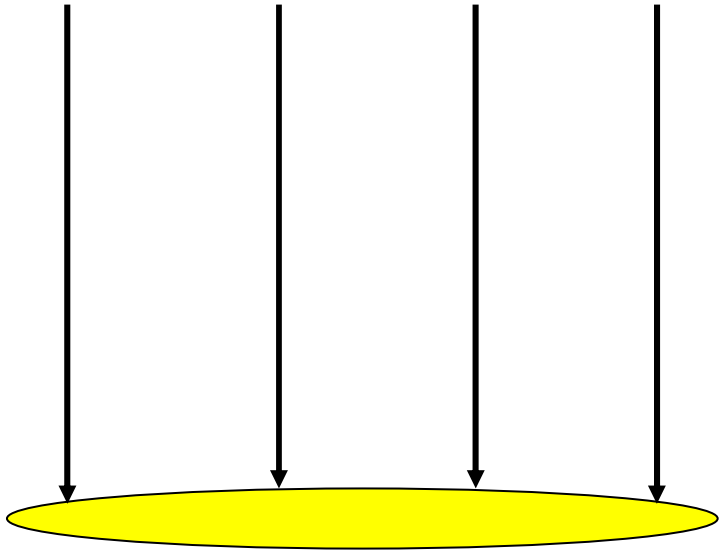
System



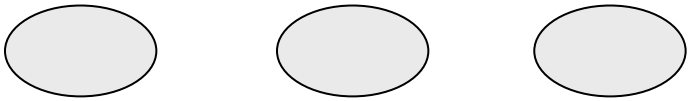
•Operators as sole service personalization agents

Mobile clothing

Subsystems



Service bundles



•Clothing as a mass customization platform

•Mobile clothing as a personalized service configuration

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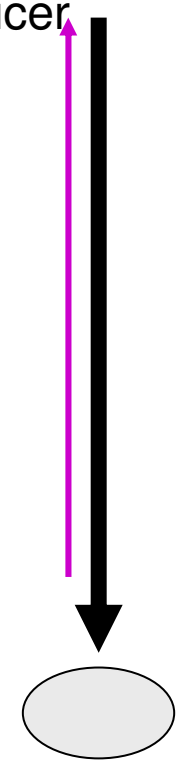
Supply chain differences II : effect on supply chain margins

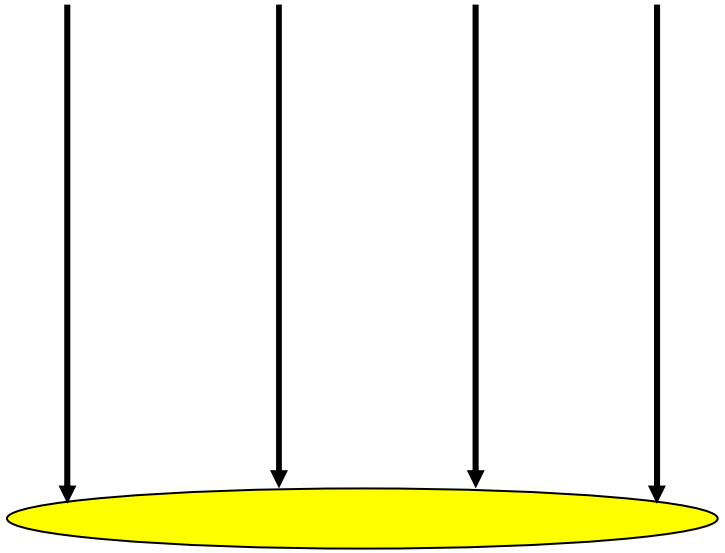
Mobile terminals

Producer

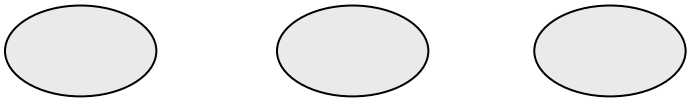


Mobile clothing

Subsystems



Service bundles



•Distributer expects same high margin as Producer in a monopolistic position

•Clothing distributors compete and impose their low margins on distributed and competing subsystems suppliers

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Supply chain shifts

1) Clothing distribution networks and fashion brands to take on « all-in-1 » mobile clothing (eg Levi Strauss , specialist clothing suppliers , soon VF Corp and H&M) to offer high value customization services
2) Normal high customer retention marketing and publicity campaigns of top-branded clothing industry to rival out those by mobile terminals
3) Electronic subsystem suppliers to welcome high rotation supply contracts by clothing assembly and distribution companies , allowing to complement or bypass integrated mobile terminals vendors
4) It is a welcomed challenge given clothing assembly and textile manufacturers to move into higher valued products
5) Levelling down of distribution margins in vertical mobile terminals supply chains
6) Terminals architect role to be taken over or to rival industrial fashion and design specialists

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Supply chain shift implications

- In line with technology management theories, vertically integrated new industries get exposed to fragmentation driven by end users,outsourcing and product/channel concepts from other industries (eg.: car , car parts and automotive electronics)
- They also get exposed to internal inefficiencies and slower platform evolutions
- Mobile terminals vertical companies are now exposed to fragmentation, because of platform and systems complexities,and because of the growing power of independent product integrators sourcing subsystems from multiple competing sources
- Low cost, high flexibility agile product integrators with powerfull pre-existing channels (such as textile and clothing), betting on standardized technologies, have specific opportunities

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Business process modeling

- Formal BPM models established (with parametric estimates or assumptions) for both mobile terminals as well as for mobile clothing
- Models allow to carry out full impact analysis on end customers, industrial players, throughput, net manufacturing margins (not on R&D).

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Changing mixes in design, manufacturing and distribution

	Mobile terminal			
		Share in design	Share in manufacturing	Share in distribution
	SUPPLIERS			
	Mobile terminal platform & testing	35	22	
	RT Software	15	12	
	Applications software	10	6	
	Displays	8	12	
	Microelectronics circuits & assembly	24	49	
	Mechanics & power	6	16	
	Packaging	2	5	
		100	100	
	CHANNELS			
	Operator			60
	Electronic shops			30
	Enterprise applications			10
	Clothing embedded communications			
		Share in design	Share in manufacturing	Share in distribution
	SUPPLIERS			
	Textile materials	3	6	
	Clothing manufacturing	8	20	
	Mobile terminal platform	20	15	
	RT Software	17	14	
	Applications software	8	5	
	Displays	10	14	
	Microelectronics circuits & assembly	20	10	
	Mechanics & power	11	13	
	Pressing & Packaging	3	3	
		100	100	
	CHANNELS			
	Agent			40
	Shop networks			45
	Enterprise dresses & applications			15

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Changing mixes in supply chain , with product price and profit implications

Euros/unit	Mobile terminal	Clothing embedded
SUPPLY CHAIN MIX		access
Manufacturing	80	65
Manufacturing profit	40	19,5
%	50	30
Value of clothing		15
Profit on clothing		7,5
%		50
Distribution cost	55	35
Distribution profit	16,5	10,5
%	30	30
Inventory rotation days	45	15
Enhancements		40
Accessories	30	
SALES PRICE	**221,5**	**192,5**
Cost of goods sold	105	120
	Electronics manufacturer	**Clothing manufacturer**
PROFITS	35,6	13,16
	Clothing manufacturer	**Electronics manufacturer**
	0	13,85
	Channel	**Channel**
	16,5	10,5
	Service revenue	**Service revenue**
	0	40

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Conclusion

- Mobile clothing is a powerfull re-intermediation agent of current mobile platform supply chains
- It offers strong branding and customization possibilities at low cost to end users
- Textile and clothing industries , starting with specialist clothing and fashion, will become small but significant change agents while reaping the rewards mobile terminal suppliers will loose
- This trend can only be slowed down by less capital and innovation funding in textile and clothing industries
- This trend will drive the proliferation of wireless access device suppliers and strengthen supplier independent distributors